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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/616,606	07/14/2000	Douglas P. Hart	0050.2015-000	6151

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EXAMINER

HESELTIME, RYAN J

ART UNIT PAPER NUMBER

2623

DATE MAILED: 01/16/2004

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/616,606

Applicant(s)

HART, DOUGLAS P.

Examiner

Ryan J Hesseltine

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 September 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2 and 5-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2 and 5-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 July 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 8. 6) ☐ Other: _____

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on September 24, 2003 was filed after the mailing date of the non-final rejection on May 23, 2003. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Response to Amendment

2. The declaration under 37 CFR 1.132 filed September 24, 2003 is sufficient to overcome the rejection of claims 1, 2, and 5-20 based upon "High resolution, ultra fast 3-D imaging" to Rohaly et al.

Response to Arguments

3. Applicant's arguments on page 6, second paragraph, filed September 24, 2003, with respect to the drawings have been fully considered and are persuasive. The objection to the drawings has been withdrawn.

4. The rejection of claims 3 and 4 are rendered moot by applicant's cancellation of those claims.

5. Applicant's arguments on page 6, paragraphs four to eight, filed September 24, 2003 have been fully considered but they are not persuasive.

6. In paragraph five, applicant states, "Altschuler's statement [column 1, line 57-60] relates to correlation and suggests that such correlation is too slow and, therefore, teaches away from using correlation processing of images." The examiner agrees that in this portion of the Altschuler patent (USPN 4,294,544), it is stated that correlation in stereophotogrammetry

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requires a human operator and is therefore too slow for real-time applications, but this portion of the specification relates to the prior art deficiencies that are to be overcome by the disclosed invention (column 1, line 49-57). Later, in the summary of the invention, it is stated that comparative topographical mapping is performed by correlating illuminated surface spots with both imaged spots and individual laser beams (column 4, line 1-9), and in the detailed description, a space coding scheme is described to automatically correlate a bright dot seen in the TV camera with the shutter column *u* of the laser beam which illuminated that spot for each laser beam image (column 14, line 40-45). Therefore, the Altschuler reference does not teach away from the combination with the Hart reference (USPN 5,850,485).

7. In paragraph seven, applicant states, "Gharib discloses rotation of a shutter (or blocking element) in relation to an aperture with three fixed openings (col. 4, lines 8-13)." In paragraph eight, applicant states, "With Gharib, the positions of the aperture openings are fixed and cannot be altered; with the present system, there can be any number of positions of the aperture opening by rotating the aperture element." The examiner understands applicant's statements with respect to the cited portion of the Gharib patent (USPN 6,278,847), but respectfully disagrees with applicant's conclusion. In column 3, lines 56 to column 4, line 7, Gharib explicitly states that a mask 400 includes multiple apertures consisting of an associated selective blocking means 402 which either allows light to pass through the aperture or blocks light from passing (Figure 4a). Gharib goes on to state that the aperture blocking means 402 can be a mechanical blocker (shutter), solid state optics such as liquid crystal, or a digital mirror. The portion of the reference cited by the applicant (column 4, line 8-13) refers to alternative ways of obtaining the three images and is not necessarily the preferred method. The examiner would like to point out that

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the claims do not contain a limitation directed to “non-equilateral spacing of the aperture openings” (page 6, last paragraph).

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claims 1, 6, 7, 9 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Hsueh et al. (“Real-time 3D topography by speckle image correlation” document AT on applicant’s IDS, see whole document).

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 1, 5-7, and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Altschuler et al. (USPN 4,294,544, previously cited), hereafter Altschuler, in view of Hart (USPN 5,850,485, cited on applicant’s IDS).

12. Altschuler discloses an imaging system and method for imaging a target in three dimensions (column 4, line 43-50), the system comprising: a light projection source for projecting a beam of light onto the target (column 4, line 63-68); an image acquisition subsystem for acquiring at least two images from light reflected by the target (column 6, line 1-12; column

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10, line 16-18); and a correlation processor for processing the acquired images (column 14, line 40-45). Altschuler does not disclose that the images are processed according to a sparse array image correlation process.

13. Hart discloses a sparse array image correlation system and method wherein two images are cross-correlated using a sparse array image correlation method (column 9, line 45-58). It would have been obvious to one of ordinary skill in the art at the time the invention was made to correlate the images using sparse array image correlation as taught by Hart in order to obtain a much faster correlation result between the two images (column 8, line 15-25).

14. Regarding claim 5, Altschuler discloses that the subsystem comprises a lens, an aperture element and a camera disposed along an optical axis (inherent) and wherein the camera includes a single CCD element (column 9, line 13-25).

15. Regarding claims 6 and 9, Altschuler discloses the light projection source includes a diffuser (producing a divergent beam array) for projecting a beam of light having a random pattern (column 6, line 38-54).

16. Claims 2, 8, and 10-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Altschuler in view of Hart as applied to claims 1 and 7 above, and further in view of Gharib et al. (USPN 6,278,847), hereafter Gharib.

17. Regarding claims 2 and 8, Altschuler discloses that the subsystem comprises a lens, an aperture element and a camera disposed along an optical axis (inherent) and that at least two images are acquired sequentially from different angles (column 9, line 64 to column 10, line 18), but does not disclose an aperture element including an opening offset from the optical axis.

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Gharib discloses an aperture coded camera for three-dimensional imaging wherein the aperture element includes an opening offset from the optical axis (column 1, line 43-50) and the image acquisition subsystem further includes rotation means for rotating the aperture element about the optical axis such that the at least two images are acquired sequentially from different angles (column 3, line 56 to column 4, line 7). It would have been obvious to one of ordinary skill in the art at the time the invention was made to sequentially acquire at least two images from different angles using an aperture element including an opening offset from the optical axis as taught by Gharib in order to generate a three-dimensional model of an object using a single camera without having to move the camera (as in Altschuler, column 10, line 16-18) to different image capture positions by obtaining multiple exposures at different times (column 2, line 65 to column 3, line 6).

18. Regarding claims 10 and 16, Altschuler discloses an imaging system having a lens, an aperture element and a camera disposed along an optical axis (inherent), an imaging method for imaging a target in three dimensions (column 4, line 43-50), the method comprising: projecting a beam of light onto the target (column 4, line 63-68); acquiring a first and second image at the camera from light reflected by the target through the lens (column 6, line 1-12; column 10, line 16-18); and processing the acquired images according to an image correlation process to resolve three dimensional components of the target (column 14, line 40-45). Altschuler does not disclose rotating the aperture element such that an opening of the aperture element offset from the optical axis is set to first and second positions.

19. Gharib discloses an aperture coded camera for three-dimensional imaging wherein the aperture element includes an opening offset from the optical axis (column 1, line 43-50) and the

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image acquisition subsystem further includes rotation means for rotating the aperture element about the optical axis such that the at least two images are acquired sequentially from different angles (see above discussion of claims 2 and 8).

20. Regarding claim 11, Hart discloses that the processing includes processing the acquired images according to a sparse array image correlation process (see above discussion of claims 1 and 7).

21. Regarding claims 12 and 17, Hart discloses processing of the acquired images according to a sparse array image correlation process which comprises forming first and second image arrays of pixel values from respective first and second images, each pixel value associated with one of a number of pixels, selecting pixel values in the image arrays which are beyond a pixel threshold value, and performing a correlation process on the selected pixel values comprising creating first and second sparse image arrays of the selected pixel values and their locations in the respective first and second image arrays, performing individual correlations successively between pixel entries of the first sparse image array and pixel entries of the second sparse image array within a pixel distance of each other, and cumulating the correlations in a correlation table at respective distance entries (see above discussion of claims 1 and 7; column 5, line 63 to column 6, line 48; column 9, line 45-58).

22. Regarding claims 13 and 18, Hart discloses that the processing further includes recursive correlation (column 7, line 56 to column 8, line 14; column 9, line 45-58).

23. Regarding claims 14 and 19, Hart discloses that the correlation processor provides correlation error correction (column 6, line 49-65).

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24. Regarding claims 15 and 20, Hart discloses that the correlation processor provides sub-pixel resolution processing (column 5, line 42-54).

Conclusion

25. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. USPN 5,831,736 to Lichtman et al. discloses a method and apparatus for generating a three-dimensional topographical image of a microscopic specimen using a disc-shaped body having an offset aperture rotatable about the optical axis.

26. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ryan J Hesseltine whose telephone number is 703-306-4069. The examiner can normally be reached on Monday - Friday, 8:30 AM - 5 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on 703-308-6604. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-0377.

rjh
January 7, 2004


JINGGEWU
PRIMARY EXAMINER